

MANN.

A description of the compound  
microscope... [n.d.]

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A

DESCRIPTION

OF THE

COMPOUND

(Commonly call'd the Reflecting or Double)

MICROSCOPE,

With Great IMPROVEMENTS.

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BY

JAMES MANN and JAMES AYSCOUGH,

At the Sign of Sir Isaac Newton and Two Pair  
of Golden Spectacles, near the West-End of  
St. Paul's, LONDON.



DESCRIPTION

OF THE

COMPASS

QH  
211

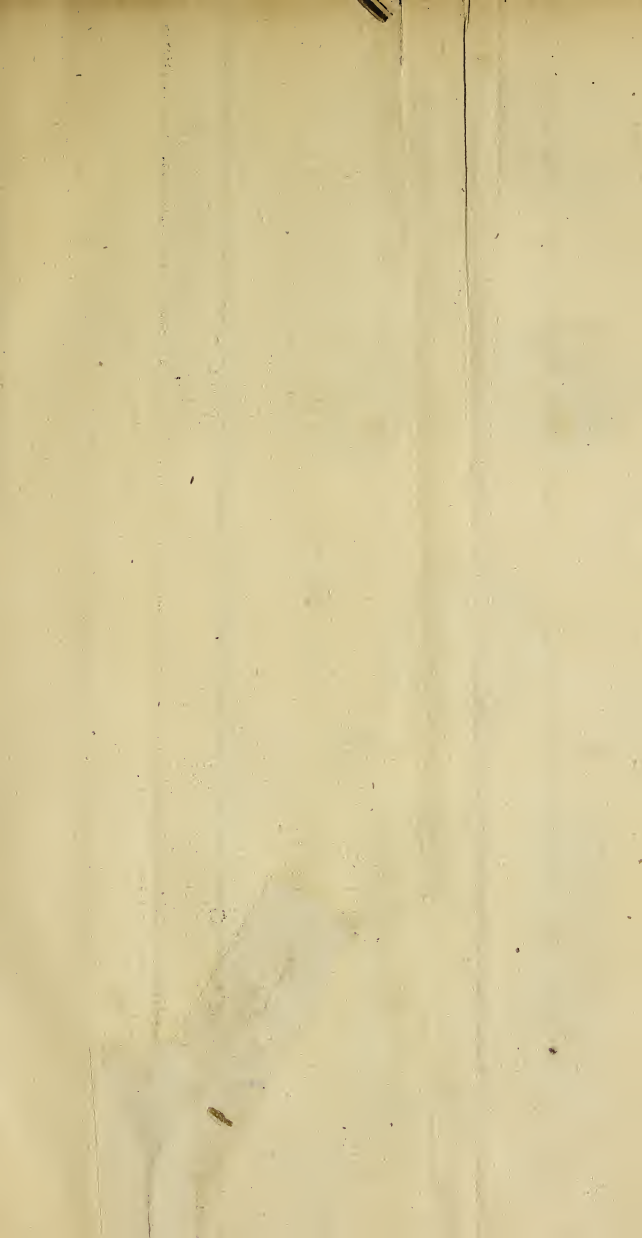
M 281

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MICROSCOPE

With Great Improvements







The Compound Microscope Improved  
 By JAMES MANN, & JAMES AYS COUGH, at the Sign of S<sup>r</sup> Isaac Newton,  
 in Ludgate-Street, LONDON.









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T H E

I N T R O D U C T I O N .

**A**MONG the various Branches of Philosophy, the Science of Opticks, seems for some years past to have been one of the favourite Entertainments of the Learned: The Phænomena of this Curious part of mixt Mathematicks, affords us a most noble Display of the Works of Nature.

During the last and present Century, every Artist has met with a most favourable Reception, who has attempted the Improvement of any Instrument tending to the advancement of Astronomical, or other Optical Discoveries; and as few are so perfect, as not to admit of considerable Amendments, our first Endeavour was some time ago to remedy some Imperfections we observed in the REFRACTING TELE-

LESCOPE, which we soon effected to our own great Satisfaction ; and it has likewise been favoured with the Approbation of the best Judges in Theory, as well as of those Gentlemen whose NAVAL, or MILITARY Capacity, has made them more than ordinary Conversant with the Use of it : This Improvement 'tis certain is of no small Consequence towards the Compleatness of the Instrument, and we doubt not, but upon every Tryal, will carry with it its own Evidence, as it is founded on the justest Principles, and Rules of Opticks.

This Success in the Telescope encouraged us to the Examination of another Instrument, no less useful, as well as entertaining, *viz.* the Microscope.—It is a Maxim in Philosophy, that Nature is never more perfect, and entire, than in the Minuteest Objects : The Microscope being adapted to such Objects, opens to us a world of wonders, some of which would wholly escape the Eye, and others at best appear confused and indistinct.

It would be tedious to take particular notice of the several kinds of Microscopes that have been invented, they may in general be reduced to these two, *viz.* the simple, and  
 compound,



compound, the last of which, from its being of more general Use, and taking in a larger Object at one view, than a single Lens of the same Magnifying Power can do, has been most universally, as well as deservedly esteemed; and notwithstanding the many alterations at different times made in the Structure of this Instrument, yet on a more nice Examination we found it capable of very considerable Improvements.

The chief Excellency of any Microscope, consists in the Degree of the Magnifying Power under which the Objects may be seen with Distinctness; and the ready, and most convenient placing, the Object to be viewed. With respect to the first of these; in the Structure of our new Microscope, we have had particular regard, to the most advantagious situation of the Glasses, and have been able to remedy some Imperfections, which though to be found in all Microscopes hitherto made, had escaped being taken notice of, by which means the Object is rendered more distinct than in any other, as we shall be ready to satisfy any curious Person desirous of making the Comparison.

For the more convenient placing the Objects to be viewed, we have contrived the Stage on which they are to be placed, very different, and much more ready for use than any other ; and by making it move on the Pillar, to which the Microscope is fixed, the Object is much easier brought to the proper Focus of the several different Lenses ; and the many inconveniencies which by experience has been found to attend the moving the Body of the Microscope for that purpose, are hereby prevented.

In order to render it the more Portable, we have contrived, that the Microscope, together with its whole Apparatus shall be contained in a Box not exceeding twelve Inches in Length, five Inches in Breadth, and three Inches in Depth, and which serves as a Base, or Stand, to support the Instrument, being made so as to be put together with the greatest ease and readiness imaginable, and upon the whole we flatter ourselves, it will be found in many respects to excell any Instrument of the Kind yet Extant, but, as Experience is the best Proof how far these Alterations

tions

tions have been attended with the desired Success, we shall with the greatest readiness gratify the Curiosity of any ingenious Gentlemen who are desirous of making the Comparison, and humbly submit it to their Judgment, being their

*Most Obedient and very*

*Humble Servants*

**JAMES MANN,**

**JAMES AYSCOUGH.**

## DESCRIPTION, &amp;c.

A. **R**epresents the Box, in which is contained all the Apparatus, when packed up for Carriage, and is the Base or Stand, to support the Instrument when used for Observations. On the Top of this Box is fastened a Brass Plate or Dovetail, which the Base of the Brass Pillar B slides on, and is thereby firmly fixed.

Note, In order to preserve the Edges of the Dove-tail from being bruised, there is a Brass Plate slides over it, which must be taken off before the Pillar can be put on.

C. The Body of the Microscope, which fixes in a circular Collar, at the Top of the Pillar at *a a*, and is taken in and out at pleasure: Care must be taken, when used, to fix it in tight.

D. Is an Horizontal Plate, or Stage, on which any of the Parts for holding Objects for Observation are placed: This Stage, for the conveniency of packing, is taken off, and on, with ease at *b*, and being much easier in its motion for adjusting, than the large Body, it is therefore fixt to a square Brass Collar E, moving up and down the Pillar. The Body C being firmly fixt without any motion. On the Top of the Stage is a thin round Plate, under which the Ivory Sliders must be placed, it being



ing made with a proper Spring, so as to give way for their Reception; and under the Stage is a proper Cavity for to hold a Glass Tube, which springs in the same manner.

**F.** Is a semicircular Brass Frame, holding a Concave and plain Glass, which by placing at a proper Angle receives a Light from the Sky or Candle, and throws it upwards on the Object fixt on the Stage to be examined: The Stem of the Semicircle must be fixt in one of the Holes in the Pillar at 1. 2, as the Observer shall find most requisite.—The three greatest Magnifiers will probably require it at 1.

**G.** A double Convex Lens, which turning on two Screws, transmits light to assist in illuminating Opake Objects. The long Cylindrical Part *c*, is placed in the spring Tube *d*, fastened to one Corner of the Stage.

**H.** Is an Ivory Slider with four Holes, in which any very minute Object may be confined between two piece of Muscovy Tales or Isinglass. Of these the Curious may be supplied with what number they please, eight only are sold with the Microscope, six of which are filled with Objects, and are numbered 1, 2, 3, 4, 5, 6, 7, 8, and contain the following Objects, beginning with the Hole next the sharp End of the Slider.

N<sup>o</sup> 1.

N<sup>o</sup> 2.

N<sup>o</sup> 2.

N<sup>o</sup> 3.

N<sup>o</sup> 4.

N<sup>o</sup> 5.

N<sup>o</sup> 6.

N<sup>o</sup> 7 and 8. are without Objects, for the viewing the Animalcula in Liquids, &c. or to put in Objects occasionally.

I. A Brass Pan, whereon to fasten Gudgeon or a any small Fish, to see the Blood circulate in its Tail. In order for this, the Tail of the Fish must be spread a-croſs the oblong Hole *e*, at the ſmall End of the Pan: Then ſlipping the Button *f* into the Slit *g*, through one Corner of the Stage, the Spring at the bottom of the Stage will fix it ſteady for viewing. The Fish muſt be tied on with a Ribband, to prevent its ſtruggling.

K. Is a Glaſs Tube, which for viewing the Circulation in a Frog, or Newt, is more convenient, becauſe the Object is more eaſily confined. In a Newt or Eel, the Tail is the beſt Part; but in a Frog, the Web only between the Toes can be viewed, no other part being enough transparent: When the Object is well expanded in the inſide of the Tube, ſlide it through the Cavity under the Stage, and bring the part to be viewed exactly under the Magnifier. There are ſeveral of theſe Glaſs Tubes of different ſizes, and the more confined the Creature is, the eaſier he is managed, and the quieter will lie to be examined.

A Frog is represented in the Tube, to ſhew the Poſition it ſhould lie in.

h. A long Wire, with a Worm at one End to pull out the Cotton kept in the Tubes to prevent their breaking, and likewise to clean the Tubes when foul, by winding ſome Cotton round the Worm, and rubbing it about within them.

L. Is a Brass Cell that contains a ſmall Lens, which is called the Magnifier: This ſcrews on



to the End of the Brass Snout at *k*: There are six of these Glasses belong to the Microscope, of so many different Focus's, or degrees of magnifying Power, and are each used occasionally, according to the size of the Object to be examined, which must be left to the Judgment of the Observer.

M. A Brass Cone to fasten in the Shank underneath the middle of the Stage. The principle Use of this Cone is, when any very transparent Objects are viewed with the first, second, or third Magnifiers: For Experience shews, that by intercepting some part of the oblique Rays reflected from the Concave Looking-Glass, such Objects are rendered much more distinct; particularly in viewing the Circulation of the Blood, of which, in all other Microscopes hitherto made, there was no Contrivance for to use this, in that curious Observation.

N. Is a hollow Cylinder with its sides open, to the End of which, is screwed a Concave silver speculum *l*, having a round Hole in the middle of it. This Cylinder sliding over the Snout of the Microscope *m*, and the top Edge set to the Mark corresponding with the Mark on the Magnifier used, a strong Light becomes reflected from the Silver Speculum on any opaque Object under Examination, The Concave or plain Mirror in this, as well as in all other Observations, may be either of them used, as you find by Experience best answer.

The Silver Speculum is in an Ivory Box, to prevent its tarnishing.

O. A long Steel Wire, with a pair of Spring  
Tongs



- Tongs at one End, to hold a Leaf or small Insect; at the other End is a point to stick any Object on. This slides backward and forward in a spring Tube *n*, fastened to a Joint with a short Shank *o*, that puts into a round Hole of the Slit in the Stage at *g*.
- P. A little block of Ivory, white at one end, and black at the other, for Objects to be placed on according to their Colour, with a Hole through the middle to stick it on the Point of the Wire *O*. On this Block, Salts, Sands, or other small opaque Bodies are to be laid, or stuck on with Gum, in order to be viewed, with the Assistance of the reflecting Light from the Silver Speculum. It is made thus small, that it may obstruct as little as possible, the Rays thrown up from the Concave or plain Looking-Glass.
- Q. A round Cell or Box to confine small Insects between two Glasses, one of which is concave, the other plain. This Cell is to be placed over the Hole in the Center of the Stage, first having the Hole covered with the plain Glass *q*, you must move it about till you bring the Object exactly under the Magnifier.
- R. A concave Glass, wherein to place a Drop of any Liquid occasionally to be examined.
- S. A Glass Cylindrical shallow Vessel, for holding a Tea-spoonful of Water, to view the larger Kinds of Objects, as the Polype, or such like.
- T. A Hand-Magnifier, very useful for preparing Objects for the Microscope, or for the examining

aming Coins, Medals, or engraving of any kind.

V. An Ivory double Box with Covers screwing on at each End; in this is contained a number of Ifinglafs, and Rings of Wire to fasten them in the Sliders.

W. A pair of Forceps or Nippers, for taking up, or adjusting any Object, to be examined.

X. A soft hair Brush to clean the Glassses, or take up a drop of any Liquid to lay on the Sliders.

Having thus described every particular part of the Apparatus, it will be necessary we should give some Directions for the Method of viewing any Object; in which we will be as particular, tho' as concise as possible.

Suppose you would view any Object in an Ivory Slider, thrust the Slider under the circular Brass Plate, on the Top of the Stage at *r*, one End of the Slider is made sharp for that purpose; having the Object placed in the Center, and exactly under the Magnifier, slide the Stage D up or down, till the upper Edge of the square Collar E is exact to the Mark on the Pillar corresponding with the Mark or Number of the Magnifier you then use; for instance, suppose your Magnifier N<sup>o</sup> 2, you must then slide the Collar E, till the upper Edge comes to the Figure 2 on the Pillar, there you fix it tight by a turn of the Button 3, having then directed your Light from the Glass F, suppose your Object should not be quite distinct, then by a small turn of the Button 4 one way or the other, you find the exact Focus, and see the Object clear and perfect.

But

But if you examine any Object either on the Steel Wire O, or in the Glass Tube K, the Figures on the Pillar are not to be regarded, because the Steel Wire stands higher on the Stage, and the Tubes underneath; so that your Sight and Judgment must guide you in this, by moving the Stage up or down till you come nearly to the Focus, and then by the Assistance of the adjusting Screw, as before, you'll see the Object distinct. The same must be observed when you use the Concave R, the Glass Vessel S, or the Fish-pan I, as a small Experience will presently shew.

If you would view an opaque Object, fit the little Block P on to the End of the Wire O, and if the Object be white place it on the black, if black on the white side: Then put the Cylinder N (with the Silver Speculum *l* at the End of it) over the Snout of the Microscope; bring the top Edge of the Cylinder to the Figure on the Snout, answering to the Figure of the Magnifier you use, then slide the Collar E up or down till you see the Object tolerably clear, fix it tight by the Screw Button 3 as before directed, and then bring it exactly to the Focus by the adjusting Screw 4. If your Object is large, such as a common Fly, this Contrivance does not so well answer, but the Convex Lens G must be made use of, by a Light being thrown through it, from the Sky or Candle.

It will be necessary, for the more distinctly viewing any Object, that care be taken the Glasses are kept very clean, which may be done by wiping them with a clean linnen cloth, having first breathed on them, or dipped them in Spirits of Wine.



A  
 DESCRIPTION  
 OF THE  
 SOLAR, OR CAMERA-OBSCURA  
 MICROSCOPE,

As properly adapted to be used with the MI-  
 CROSCOPE, described in Plate I.

Contrived by

JAMES MANN

AND

JAMES AYSCOUGH.

A B. A B. (*in Plate 2.*) **A** Circular - Frame of  
 Brass, which by the  
 Assistance of the two Nutts C C, and the two  
 Screws D D, is fastened firmly to a Win-  
 dow-shutter, a Hole being first made, to let  
 that of the Brass Circle B B easily through, and  
 the two Nutts C C being fixt in the Shutter,  
 by four little Iron Screws, the Looking-glass  
 E E is fixed to the circular Piece of Mahogany,  
 by means of a Brass Wire going through the  
 Joint, which is taken in and out at Pleasure.

**At**



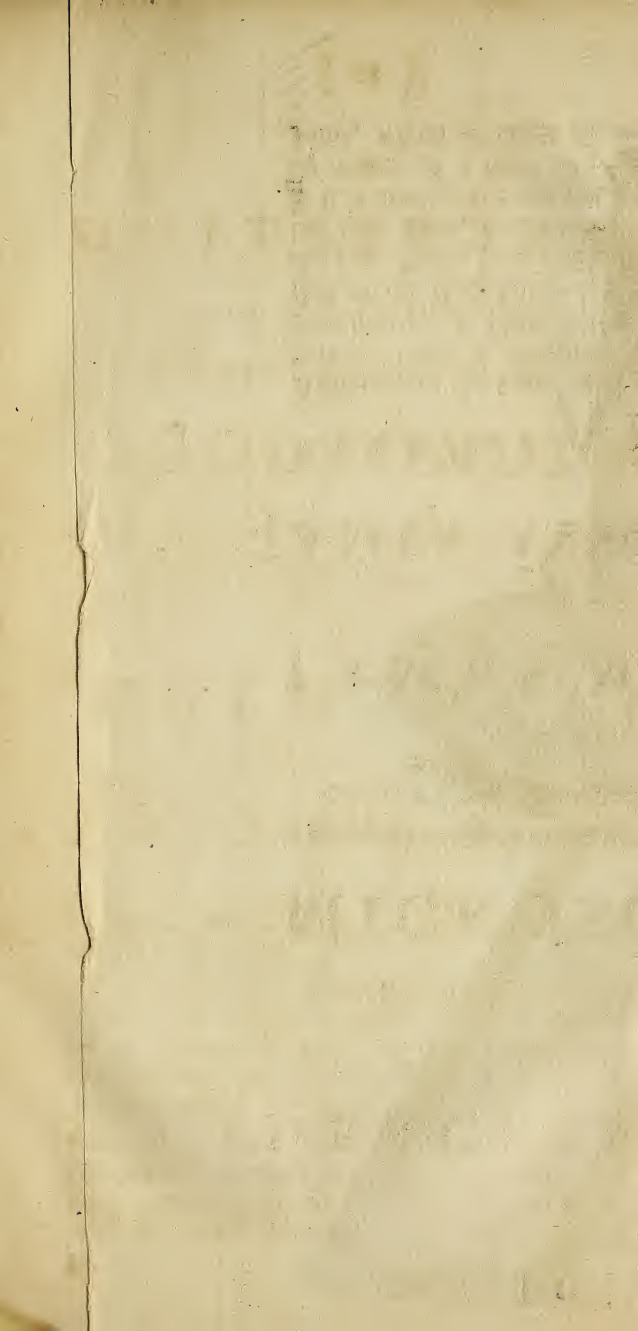
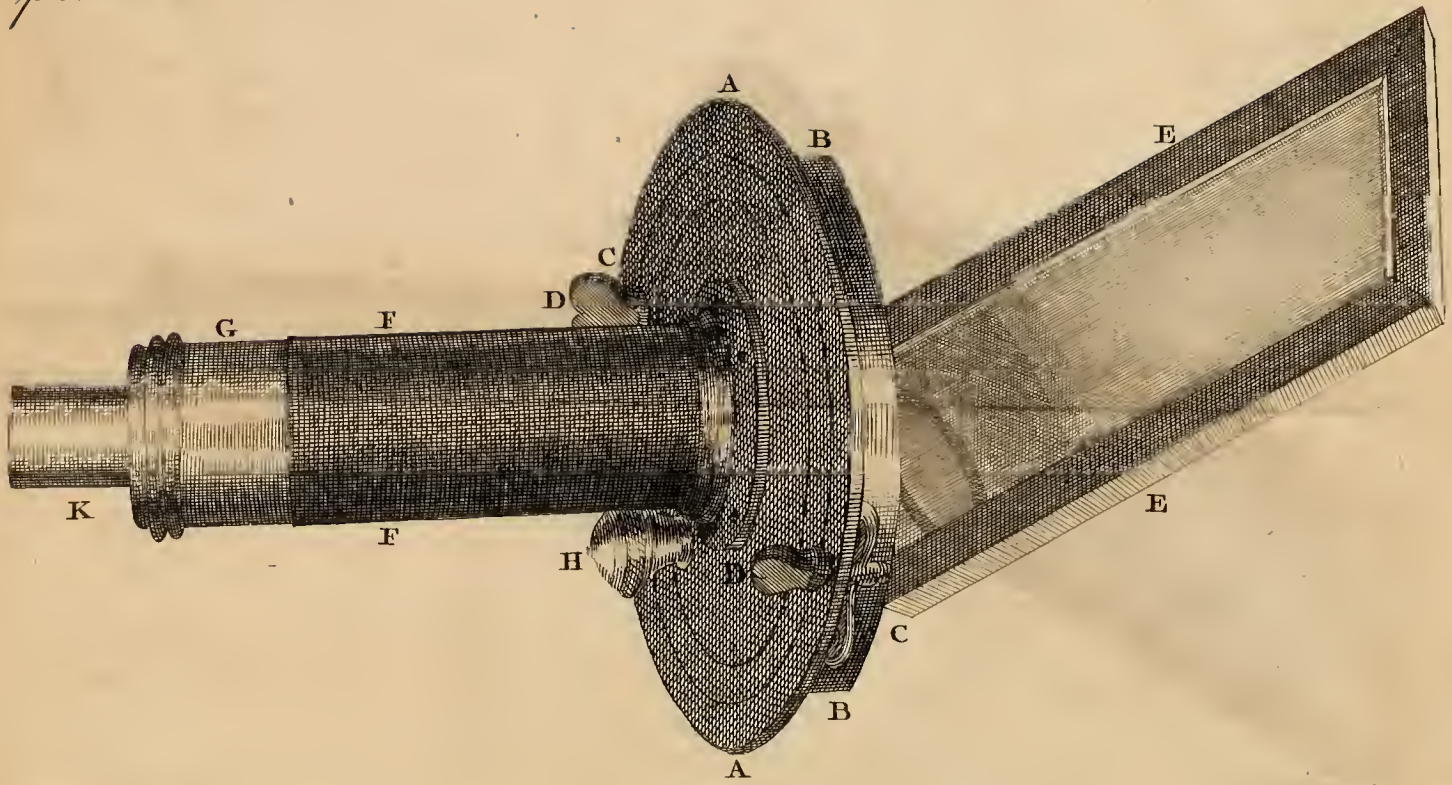




plate II.



C. Mosley sculp.





At the bottom of the Looking-Glass is a Brass Nut or Joint with a hollow Screw, that receives the Iron male Screw, which goes through the Mahogany; this must be first screwed in before the Brass Pin is put through the Joint. This being done, and the Brass Circle fastened to the Shutter, with the Looking-glass on the Outside, screw the Tube FF covered with Black into the Brass Collar, provided for it in the circular Piece of Mahogany: The Lens on the Outside is about twelve inches Focus, and a proper distance for Things that have no Life, is commonly at about ten Inches, but it must be shortened for living Objects, till they can well sustain the Heat; therefore pull out the Brass Drawer G to one of the Marks made thereon, as you find most necessary.

The Brass Knob or Button H is the Head of a Screw which goes through the Mahogany Piece, and has a Communication with the Looking-glass, which by screwing or unscrewing, elevates or depresses the Glass to the Altitude and Situation of the Sun. This Button serves also for a Handle to move round the circular Piece of Mahogany to which the Glass is likewise fixed, and by which two Motions the Sun's Rays are thrown in a direct Line through the Tube, and form a round Spot of Light on the Screen.

Things being thus prepared, take the Hollow Cylinder N (in Plate 1.) and slide it on the Tube K, till the upper Edge is exact with the Mark of that Tube, corresponding with the Mark or Number of the Magnifier made use on, which Magnifier must be screwed on to the End of the Cylinder N. Then thrust the Slider (in which your Object is placed) into the Conveni-  
 C ency

ency made for its Reception at the End of the Tube K. If the Object does not appear quite distinct, a small Turn or two of the Screw to which the Magnifier is fixed, will adjust it to a very great exactness.

Observation must be made, that as the Sun is in continual Motion, it will be required often to have the Looking-glass moved likewise; which by a little Practice is easily done to the greatest Nicety; for the Distinctness of the Object depends greatly on the Sun's Rays, being thrown exactly through the small Lens, which a small Turn of the Button H will easily do.

The properest Magnifiers for this Use is the First and Second.

This Apparatus answers the purpose for a Camera-Obscura, much preferable to the Ball and Socket; as by the Assistance of the Looking-glass, Objects are received at any Angle, and thrown in a direct Line; and if the Object is underneath the Looking-glass, it is thrown on the Screen erect. The Tubes (in this Experiment) are not made use on, and the Object Lens must be placed in the Brass Cell next the Looking-glass, the other being first taken out.

*F I N I S.*

JAMES MANN

AND

JAMES AYSCOUGH.

OPTICIANS,

At the Sign of Sir Isaac Newton and Two Pair  
of Golden Spectacles, near the West-End of  
St. Paul's, LONDON.

**M**AKE and Sell, Wholesale and Retail, the  
finest Chrystal Spectacles, ground upon  
Brass Tools (approved by the ROYAL SOCIETY  
and the greatest Mathematicians) set in Gold, Sil-  
ver, Tortoiseshell, Horn, Leather, and all man-  
ner of ways that are most convenient and beauti-  
ful. Also curious Reading Glasses of Rock  
Chrystal, or the whitest Flint, contrived to turn  
into Cases of various Kinds, to be carried in the  
Pocket without Trouble or Damage. Likewise  
Spectacles of true Venetian Green-Glass.

They make Concaves for Myops or Short-  
sighted Persons, which are so nicely adapted to  
every Degree of Short-sightedness, and by so re-  
gular a Method, that Persons, after being once  
fitted, may at all times be furnished with them  
(though at ever so great a distance) as exact as if  
present.

REFLECTING TELESCOPES on the Prin-  
ciples of Sir ISAAC NEWTON, and Mr. GREGORY,  
made with the greatest Accuracy, and the Appa-  
ratus



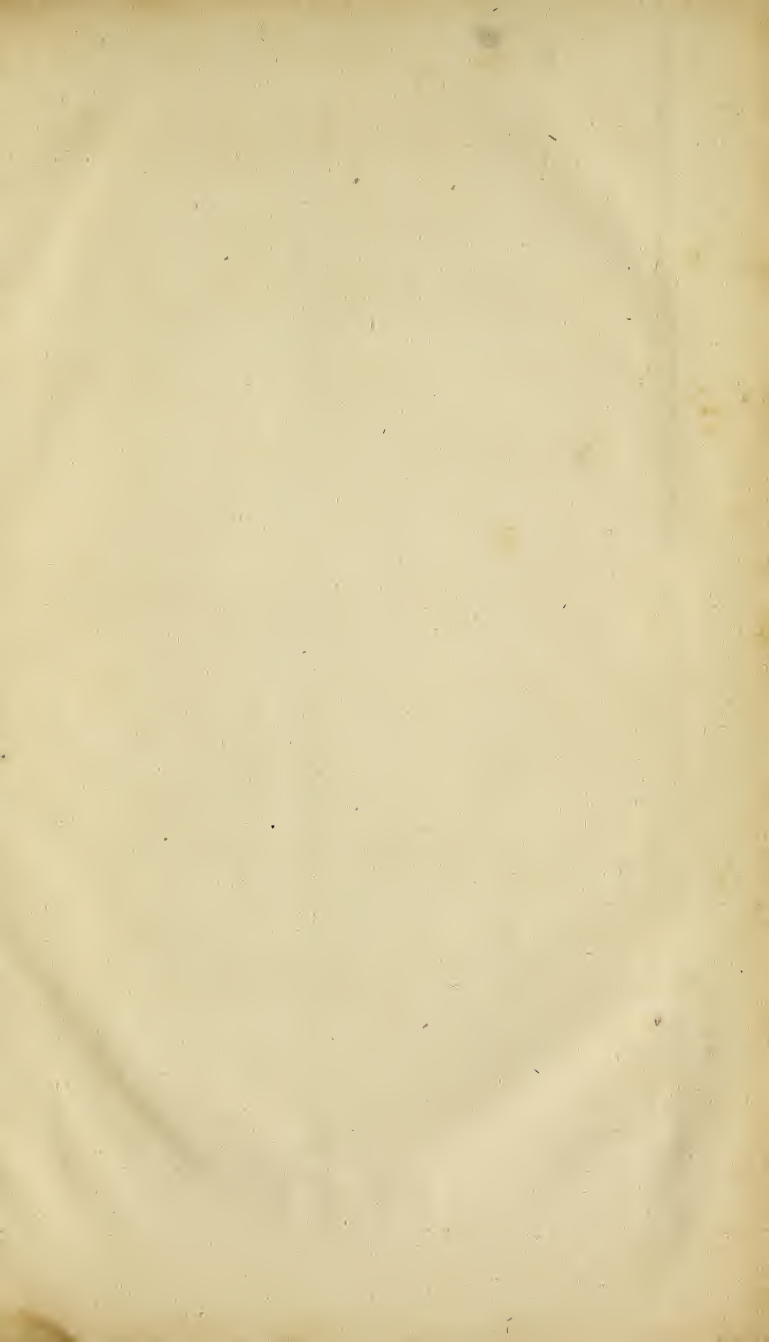
ratus finished and adapted in so compleat a Manner, as renders the Use of them pleasant and easy.

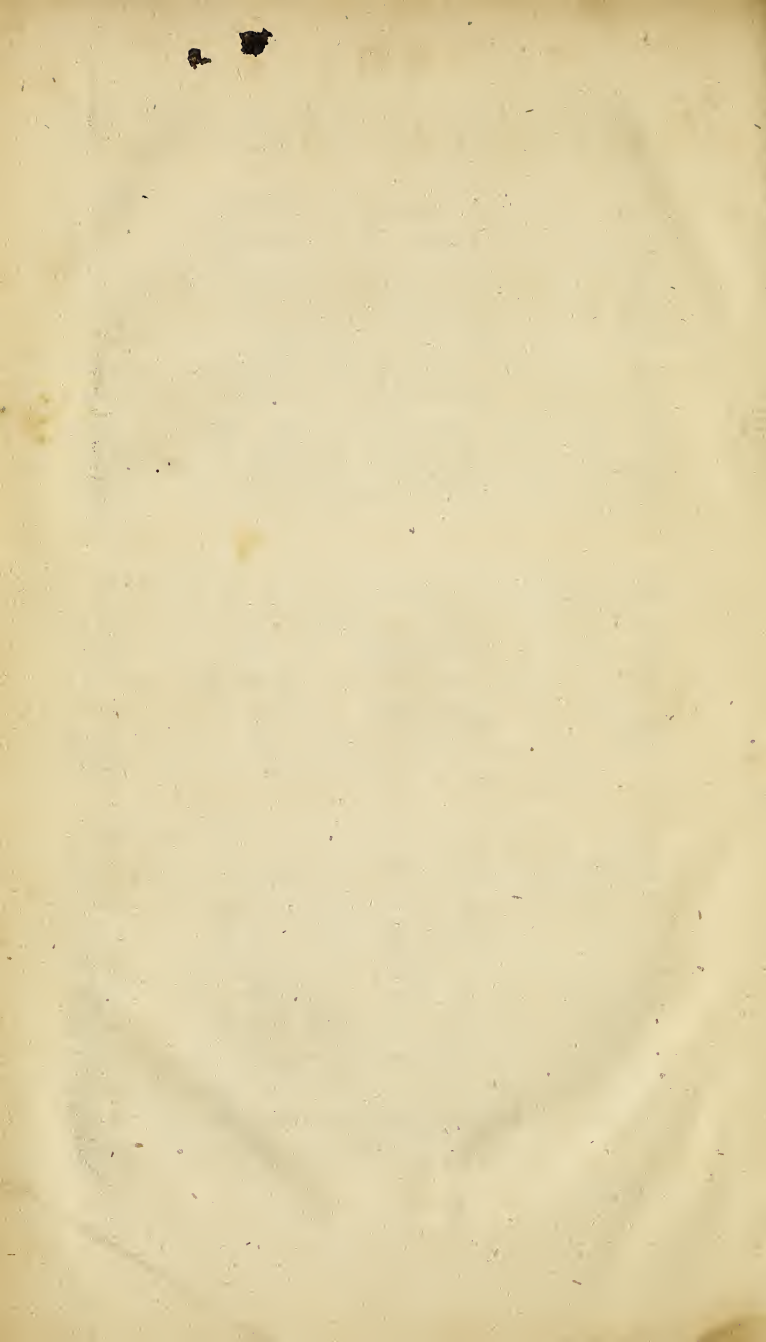
MICROSCOPES simple and compound (with great Improvements on the latter) which magnify to so great a Degree, that the Circulation of the Blood in Animals, the Animalcula in Fluids, and the Farina of Vegetables, with many other Phænomena, otherwise imperceptible, are clearly discovered.—Also an Improvement of the Apparatus of the solar Microscope, which by the Justness of its Motions, renders it much easier, as well as more advantagious for use, than any yet extant.

PRISMS for demonstrating the surprizing Theory of Light and Colours; Camera Obscura's for delienating views in Perspective, Convex, and Concave Speculums of all Sizes; Magick Lanthorns, Opera Glasses, Multiplying and Magnifying Glasses, Barometers, Thermometers; with many other Curiosities not here mentioned.

REFRACTING TELESCOPES IMPROVED, By a method founded on the justest Principles and Rules of Opticks, and are allowed by the best Judges in Theory (who have made the Comparison) to excell any yet made in *England*, and equal in all respects to those of the celebrated PETRO PATRONE at *Milan*; by which Improvement, those of two, three, and four Feet, have by Experience been found to be much more useful at Sea, than any have hitherto been, and are made ONLY by the abovesaid Operators.







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A description of the compound (commonly